# Effect of Trinexepac-Ethyl Plant Growth Regulator on Wheat Yield

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## Introduction

Growers in the high rainfall production zones of Oregon are accustomed to applying trinexapac-ethyl (TE) plant growth regulator to their grass seed crops to increase seed yield. The yield increase in grass seed production is associated with a reduction in lodging that improves pollination and seed development. With the recent introduction of TE into the cereal market, growers are interested in determining if TE will increase their yields and/or if they can apply additional N to increase wheat yields without increasing lodging risks. Plant growth regulators have been previously studied in wheat and found not to significantly increase yield, however plant growth regulators did significantly reduce plant height and lodging. In the fall of 2012 a multiyear study was initiated to determine the effect of TE with and without additional N fertilizer on wheat yield.

## Objectives

1)To determine if TE increases wheat yield with or without additional N fertilizer.

2)To evaluate the effects of TE with and without additional N fertilizer on plant height, protein content, test weight, and lodging in wheat.

## Materials and Methods

Four study sites were located in the high rainfall and irrigated wheat production regions of Oregon. Treatments were arranged in a split-plot design with four replications. Whole plots consisted of two N fertilizer rates across four TE application rate and/or timing treatments. Nitrogen fertilizer rates evaluated included a standard growers practice of 157 kg ha$^{-1}$ and a higher rate of 252 kg ha$^{-1}$. Nitrogen applications were applied in the spring at Zadoks growth stage (GS) 30. Trinexapac-ethyl treatments consisted of a single application of 0.9 L ha$^{-1}$ at GS 30, a single application of 0.9 L ha$^{-1}$ at GS 37, a split application of 0.45 L ha$^{-1}$ at GS 30 plus 0.45 L ha$^{-1}$ at GS 37, and a control. Subplots consisted of two new soft white winter wheat varieties, Kaseberg and Bobtail. Study sites were monitored throughout the growing season and standard practices were used to control weeds and pests. Prior to harvest treatments were evaluated for lodging and plant height measurements were taken. At maturity, plots were harvested using a small plot combine and measurements of grain yield, test weight, and grain protein content obtained.

OSU Extension Cereals

## ANOVA

**2014 Forest Grove, OR**

| Source of Variation | Yield | Test Weight | Plant Height | Protein Content | Lodging |
|---|---|---|---|---|---|
| Replications | NS | NS | NS | *** | NS |
| N X TE Treatments | NS | NS | *** | *** | NS |
| Variety | * | *** | NS | *** | NS |
| N X TE Treatments X Variety | NS | NS | NS | NS | NS |

**2014 Hermiston, OR**

| Source of Variation | Yield | Test Weight | Plant Height | Protein Content | Lodging |
|---|---|---|---|---|---|
| Replications | *** | *** | NS | *** | ** |
| N X TE Treatments | NS | NS | NS | *** | ** |
| Variety | ** | NS | NS | ** | *** |
| N X TE Treatments X Variety | NS | NS | NS | NS | NS |

**2013 Forest Grove, OR**

| Source of Variation | Yield | Test Weight | Plant Height | Protein Content | Lodging |
|---|---|---|---|---|---|
| Replications | *** | ** | NS | *** | NS |
| N X TE Treatments | NS | NS | *** | *** | NS |
| Variety | *** | *** | ** | *** | NS |
| N X TE Treatments X Variety | NS | NS | NS | ** | NS |

**2013 Tangent, OR**

| Source of Variation | Yield | Test Weight | Plant Height | Protein Content | Lodging |
|---|---|---|---|---|---|
| Replications | NS | *** | ** | *** | NS |
| N X TE Treatments | NS | NS | *** | ** | NS |
| Variety | NS | NS | NS | NS | NS |
| N X TE Treatments X Variety | NS | NS | NS | NS | NS |

* = $P \leq 0.05$ ** = $P \leq 0.01$ *** = $P \leq 0.001$ NS = Not Significant

## Results

**2014 Forest Grove, OR**

| N Treatment (kg ha$^{-1}$) | TE Treatment (L ha$^{-1}$) | Kaseberg | | | | Bobtail | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Yield (Mg ha$^{-1}$) | Plant Height (cm) | Protein Content (%) | Lodging (%) | Yield (Mg ha$^{-1}$) | Plant Height (cm) | Protein Content (%) | Lodging (%) |
| 157 | 0 | 10.03 a | 100.0 a | 7.6 b | 0 | 10.52 a | 100.0 a | 7.9 d | 0 |
| 157 | 0.9 at GS 30 | 10.33 a | 93.8 cd | 8.2 b | 0 | 10.71 a | 96.3 abc | 8.4 cd | 0 |
| 157 | 0.9 at GS 37 | 10.37 a | 91.3 cd | 8.2 b | 0 | 10.73 a | 87.5 e | 8.4 cd | 0 |
| 157 | 0.45 at GS 30 and 0.45 at GS 37 | 10.63 a | 93.8 cd | 8.1 b | 0 | 10.88 a | 92.5 cd | 8.8 c | 0 |
| 252 | 0 | 10.86 a | 98.8 ab | 9.3 a | 0 | 11.23 a | 98.8 ab | 9.6 b | 0 |
| 252 | 0.9 at GS 30 | 10.68 a | 95.0 bc | 9.4 a | 0 | 10.48 a | 95.0 b | 10.2 ab | 0 |
| 252 | 0.9 at GS 37 | 10.27 a | 90.0 d | 9.8 a | 0 | 11.01 a | 91.3 de | 10.1 ab | 0 |
| 252 | 0.45 at GS 30 and 0.45 at GS 37 | 11.07 a | 95.0 bc | 9.4 a | 0 | 11.00 a | 92.5 cd | 10.3 a | 0 |

**2014 Hermiston, OR**

| N Treatment (kg ha$^{-1}$) | TE Treatment (L ha$^{-1}$) | Kaseberg | | | | Bobtail | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Yield (Mg ha$^{-1}$) | Plant Height (cm) | Protein Content (%) | Lodging (%) | Yield (Mg ha$^{-1}$) | Plant Height (cm) | Protein Content (%) | Lodging (%) |
| 157 | 0 | 9.81 a | 107.5 a | 11.2 c | 8.8 a | 11.54 a | 107.5 a | 12.1 ab | 60.0 a |
| 157 | 0.9 at GS 30 | 10.42 a | 106.3 a | 10.8 c | 0 a | 10.90 a | 106.3 a | 11.1 c | 38.8 a |
| 157 | 0.9 at GS 37 | 10.58 a | 105.0 a | 11.0 c | 5.0 a | 11.46 a | 102.5 a | 11.3 bc | 43.8 a |
| 157 | 0.45 at GS 30 and 0.45 at GS 37 | 10.46 a | 105.0 a | 11.4 bc | 5.0 a | 11.73 a | 103.8 a | 11.4 bc | 46.3 a |
| 252 | 0 | 10.34 a | 105.0 a | 12.2 a | 21.3 a | 10.17 a | 107.5 a | 12.8 a | 78.8 a |
| 252 | 0.9 at GS 30 | 9.27 a | 105.0 a | 12.4 a | 8.8 a | 10.40 a | 105.0 a | 12.1 ab | 67.5 a |
| 252 | 0.9 at GS 37 | 9.99 a | 105.0 a | 12.3 a | 13.8 a | 10.24 a | 103.8 a | 12.7 a | 73.8 a |
| 252 | 0.45 at GS 30 and 0.45 at GS 37 | 9.28 a | 105.0 a | 12.0 ab | 12.5 a | 10.20 a | 106.3 a | 12.5 a | 77.5 a |

**2013 Forest Grove, OR**

| N Treatment (kg ha$^{-1}$) | TE Treatment (L ha$^{-1}$) | Kaseberg | | | | Bobtail | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Yield (Mg ha$^{-1}$) | Plant Height (cm) | Protein Content (%) | Lodging (%) | Yield (Mg ha$^{-1}$) | Plant Height (cm) | Protein Content (%) | Lodging (%) |
| 157 | 0 | 10.50 ab | 101.3 a | 8.8 d | 0 | 10.92 a | 103.8 a | 8.9 c | 0 |
| 157 | 0.9 at GS 30 | 10.60 ab | 97.5 abc | 9.3 cd | 0 | 11.39 a | 97.5 b | 9.5 bc | 0 |
| 157 | 0.9 at GS 37 | 10.42 b | 92.5 d | 9.6 bc | 0 | 11.38 a | 95.0 b | 9.4 bc | 0 |
| 157 | 0.45 at GS 30 and 0.45 at GS 37 | 10.46 ab | 93.8 cd | 9.2 cd | 0 | 11.25 a | 93.8 b | 9.6 b | 0 |
| 252 | 0 | 10.77 a | 101.3 a | 10.1 ab | 0 | 11.59 a | 106.3 a | 10.4 a | 0 |
| 252 | 0.9 at GS 30 | 10.37 b | 98.8 ab | 10.2 a | 0 | 11.62 a | 98.8 b | 10.5 a | 0 |
| 252 | 0.9 at GS 37 | 10.16 b | 91.3 d | 10.5 a | 0 | 11.66 a | 95.0 b | 10.8 a | 0 |
| 252 | 0.45 at GS 30 and 0.45 at GS 37 | 10.39 b | 95.0 bcd | 10.4 a | 0 | 11.57 a | 98.8 b | 10.5 a | 0 |

**2013 Tangent, OR**

| N Treatment (kg ha$^{-1}$) | TE Treatment (L ha$^{-1}$) | Kaseberg | | | | Bobtail | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Yield (Mg ha$^{-1}$) | Plant Height (cm) | Protein Content (%) | Lodging (%) | Yield (Mg ha$^{-1}$) | Plant Height (cm) | Protein Content (%) | Lodging (%) |
| 157 | 0 | 10.00 a | 110.0 a | 10.5 a | 0 | 10.05 a | 111.3 ab | 9.4 b | 0 |
| 157 | 0.9 at GS 30 | 9.66 a | 110.0 a | 9.2 a | 0 | 9.63 a | 111.3 ab | 9.4 b | 0 |
| 157 | 0.9 at GS 37 | 10.55 a | 100.0 b | 9.8 a | 0 | 10.20 a | 100.0 d | 9.2 b | 0 |
| 157 | 0.45 at GS 30 and 0.45 at GS 37 | 10.29 a | 105.0 ab | 9.9 a | 0 | 9.87 a | 105.0 cd | 9.5 b | 0 |
| 252 | 0 | 9.90 a | 108.9 a | 10.7 a | 0 | 9.72 a | 108.8 abc | 10.9 a | 0 |
| 252 | 0.9 at GS 30 | 10.01 a | 110.0 a | 10.2 a | 0 | 10.01 a | 113.8 a | 10.9 a | 0 |
| 252 | 0.9 at GS 37 | 9.05 a | 98.8 b | 10.7 a | 0 | 9.23 a | 103.8 cd | 11.5 a | 0 |
| 252 | 0.45 at GS 30 and 0.45 at GS 37 | 9.88 a | 105.0 ab | 10.5 a | 0 | 9.89 a | 106.3 bc | 10.8 a | 0 |

## Conclusions

- TE application with or without additional N did not significantly increase wheat yield.
- TE applications of 0.9 L ha$^{-1}$ at GS 37 consistently and significantly reduced plant height by 8 to 12 cm.
- Split TE applications of 0.45 L ha$^{-1}$ at GS 30 and GS 37 consistently and significantly reduced plant height 6 to 10 cm.
- TE applications of 0.9 L ha$^{-1}$ at GS 30 did significantly reduced plant height 6 to 7 cm, however plant height reduction was inconsistent across site years.
- TE applications did not significantly affect test weight or protein content.
- TE applications did not significantly reduce lodging in our study, however there was a trend for decreased lodging with TE application.
- Additional N fertilizer significantly increased grain protein by 1 to 2%.